

Annual Project Summary

Grant Information

”Testing intraplate deformation in the North American plate interior”

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Investigations and results: Year 1

The goal of this two-year collaborative project between DeMets of UW-Madison, Eric Calais of Purdue University, and Jean-Mathieu Nocquet of Oxford is to estimate deformation rates in the eastern and central United States and Canada using up-to-date GPS station velocities from these regions. Station velocities are determined via a rigorous combination of GIPSY and GAMIT velocity solutions from the University of Wisconsin and Purdue. A related goal is to ascertain the degree to which the GIPSY and GAMIT solutions are consistent with each other.

During the first year, we completed most of the raw data processing and generated preliminary velocity solutions for the GIPSY and GAMIT analyses. The GIPSY solution presently consists of well-constrained velocities for 230 North American plate stations located in the plate interior, averaged over intervals of 2 to 10 years. Figure 1 shows the most recent North American plate velocity field for the GIPSY solution (upper panel) and residual velocities for the same sites upon removal of the site motions predicted by a North American plate angular velocity vector that best-fits the site velocities. The residual velocities do not exhibit any coherent regional departures from rigid plate motion that might indicate the existence of regional deformation above the roughly 1-2 mm/yr resolution of our velocity field. Details regarding the GAMIT velocity solution are provided in the Purdue project summary.

All three collaborators met at Purdue in 5/2003 to begin comparing and combining the 3D GAMIT and GIPSY velocity solutions. Prior to the meeting, SINEX solution files that contained station velocity, location, and covariance information were generated for both the GIPSY and GAMIT solutions. Over a several-week-long period, we worked on a variety of issues, including validation of the velocity covariances, monument stability, and the velocity solution combination, all of which are necessary preludes to the work we plan for the second year of the project. Our preliminary combination of the horizontal site velocities does not reveal any evidence for coherent regional deformation. The combined vertical site rates reveal the expected pattern of post-glacial rebound and possible evidence for subsidence in some areas of the southern and central U.S.

During the second year of the project, we will generate final GAMIT and GIPSY velocity solutions, combine them, assess their consistency, and undertake modeling of hypothetical sources of North American plate deformation to determine upper bounds on any internal plate deformation.

Non-technical summary: Year 1

We spent the first year of this study processing raw GPS data for more than 200 continuous GPS stations in the central and eastern United States and Canada, and constructing site velocity solutions suitable for studying regionally coherent patterns of horizontal deformation and vertical motion. Our preliminary results indicate a high level of consistency between velocity solutions from UW-Madison and Purdue, with no evidence for coherent regional deformation at the 1-2 mm/yr resolution of our velocity field.

Published reports

Song, Y., E. Calais, C. DeMets, and J.M. Nocquet, "Testing intraplate deformation in the North American plate interior from a combined geodetic solution: implication for strain accumulation on potentially seismogenic faults in the central and eastern U.S.", AGU Fall meeting, 2003.

Data Availability

All GPS data underlying this analysis are available in public archives, including the SOPAC archive (lox.ucds.edu) and the NGS CORS archive (www.ngs.noaa.gov). Results from processing of the raw data at Purdue and UW-Madison will be made available once the complete velocity solutions are generated, combined, and edited. The final velocity solution(s) will be distributed as a SINEX file through Eric Calais (ecalais@purdue.edu).

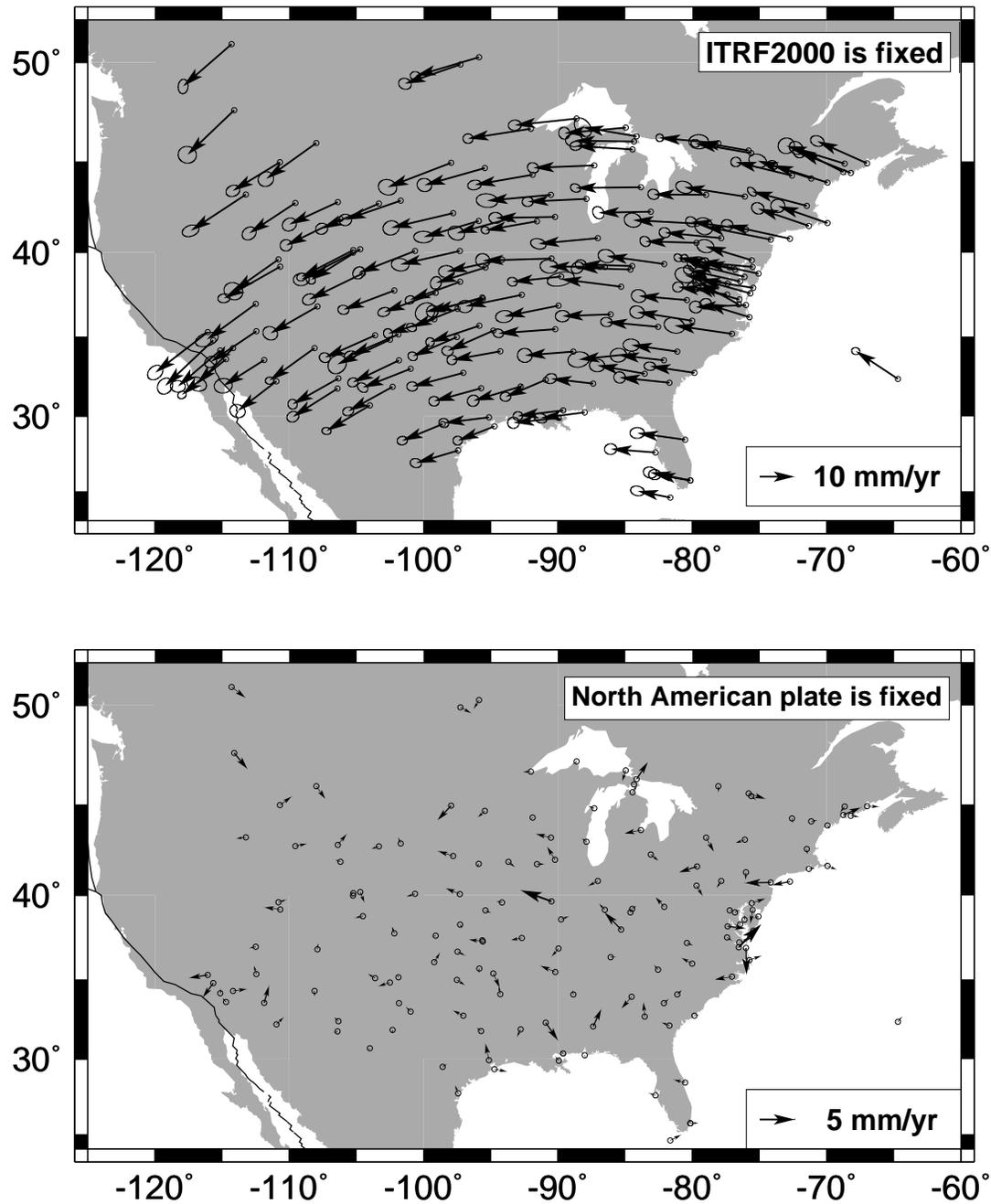


Figure 1: **Upper:** Velocities of North American plate GPS sites relative to ITRF2000. Velocities are from UW GIPSY solution. Uncertainty ellipses are 2-D, 1-sigma. **Lower:** Residual velocities of North American plate sites with respect to best-fitting North American plate motion.